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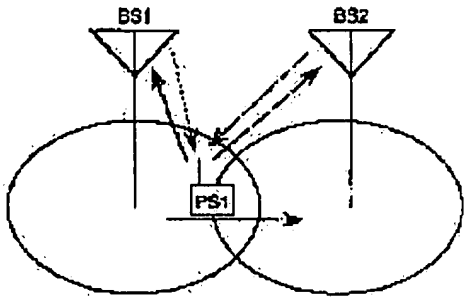
(54) TRANSMISSION POWER CONTROL METHOD AND MOBILE STATION EQUIPMENT

(57)Abstract:

PURPOSE: To attain highly precise transmission power control by allowing a mobile station to select a transmission power control bit representing a smaller power among transmission power control bits and to control transmission power of the mobile station according to the selected control bit.

CONSTITUTION: When a mobile station PS1 makes SHO (software hand-over) for base stations BS1, BS2, the transmission power of the mobile station PS1 is decided by a mobile station use TPC (transmission power) bit sent from each of the base stations BS1, BS2. That is, the mobile



station PS1 compares the mobile station use TPC bits from the base stations BS1, BS2. In this case, the mobile station PS1 decides the transmission power of the mobile station according to the TPC bit representing a smaller transmission power. As a result, a reception SIR (desired wave versus interference wave power ratio) in the base station BS1 being a source SHO is deteriorated and a channel with the source SHO is interrupted and the SHO is terminated in a short time, then the transmission power is reduced.

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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] In a CDMA system, are the transmitted power control approach in SHO which changes the communication link between a mobile station and a SHO (software handover) Motoki ground office to the communication link between a mobile station and the SHO point, and it sets to said mobile station. In the step which extracts the 1st transmitted power control bit which specifies the transmitted power of said mobile station from said signal transmitted from the SHO yuan base station, and said mobile station In the step which extracts the 2nd transmitted power control bit which specifies the transmitted power of said mobile station from the signal transmitted from said SHO point base station, and said mobile station In the step which measures the transmitted power specified by said 1st transmitted power control bit, and the transmitted power specified by said 2nd transmitted power control bit, and said mobile station In the step which chooses the transmitted power control bit which directs smaller power out of said 1st transmitted power control bit and said 2nd transmitted power control bit, and said mobile station The transmitted power control approach characterized by providing the step which controls the transmitted power of this mobile station according to the selected transmitted power control bit.
[Claim 2] In a CDMA system, are the transmitted power control approach in SHO which changes the communication link between a mobile station and a SHO yuan base station to the communication link between a mobile station and the SHO point, and it sets to said mobile station. In the step which measures the 1st SIR of said signal transmitted from the SHO yuan base station, and said mobile station In the step which measures the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station In the step which compares said 1st SIR with said 2nd SIR, and said mobile station In the step which chooses bigger SIR out of said 1st SIR and said 2nd SIR, and said mobile station The transmitted power control approach characterized by providing the step which determines the transmitted power control bit which directs the transmitted power of said both base stations, and the step which transmits said determined transmitted power control bit to said both base stations from said mobile station according to selected SIR.
[Claim 3] Said mobile station is the transmitted power control approach according to claim 1 or 2 characterized by performing said SHO using the same diffusion sign, the same transmit frequencies or a different diffusion sign, the same transmit frequencies or the same diffusion sign, different transmit frequencies or a different diffusion sign, and different transmit frequencies to said SHO point base station and said SHO yuan base station.
[Claim 4] In a CDMA system according to claim 1, it sets to said mobile station further. In the step which measures the 1st SIR of said signal transmitted from the SHO yuan base station, and said mobile station In the step which measures the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station In the step which compares said 1st SIR with said 2nd SIR, and said mobile station In the step which chooses bigger SIR out of said 1st SIR and said 2nd SIR, and said mobile station The transmitted power control approach characterized by providing the step which determines the transmitted power control bit which directs the transmitted power of said both base stations, and the step which transmits said determined transmitted power control bit to said both base

stations from said mobile station according to selected SIR.
[Claim 5] It is equipment of the mobile station which performs transmitted power control in SHO which changes the communication link between SHO yuan base stations to the communication link between the SHO points in a CDMA system. A means to extract the 1st transmitted power control bit which specifies the transmitted power of said mobile station from said signal transmitted from the SHO yuan base station, A means to extract the 2nd transmitted power control bit which specifies the transmitted power of said mobile station from the signal transmitted from said SHO point base station, A means to measure the transmitted power specified by said 1st transmitted power control bit, and the transmitted power specified by said 2nd transmitted power control bit, A means to choose the transmitted power control bit which directs smaller power out of said 1st transmitted power control bit and said 2nd transmitted power control bit, Mobile station equipment characterized by providing a means to control the transmitted power of this mobile station, according to the selected transmitted power control bit.
[Claim 6] It is equipment of the mobile station which performs transmitted power control in SHO which changes the communication link between SHO yuan base stations to the communication link between the SHO points in a CDMA system. In a means to measure the 1st SIR of said signal transmitted from the SHO yuan base station, a means to measure the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station A means to compare said 1st SIR with said 2nd SIR, and a means to choose bigger SIR out of said 1st SIR and said 2nd SIR, Mobile station equipment characterized by providing a means to determine the transmitted power control bit which directs the transmitted power of said both base stations, and a means to transmit said determined transmitted power control bit to said both base stations from said mobile station, according to selected SIR.
[Claim 7] A means by which said mobile station equipment measures further the 1st SIR of said signal transmitted from the SHO yuan base station, A means to measure the 2nd SIR of the signal transmitted from said SHO point base station, A means to compare said 1st SIR with said 2nd SIR, and a means to choose bigger SIR out of said 1st SIR and said 2nd SIR, Mobile station equipment according to claim 5 characterized by providing a means to determine the transmitted power control bit which directs the transmitted power of said both base stations, and a means to transmit said determined transmitted power control bit to said both base stations, according to selected SIR.
[Claim 8] Said mobile station equipment is mobile station equipment according to claim 5, 6, or 7 characterized by performing said SHO using the same diffusion sign, the same transmit frequencies or a different diffusion sign, the same transmit frequencies or the same diffusion sign, different transmit frequencies or a different diffusion sign, and different transmit frequencies to said SHO point base station and said SHO yuan base station.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the transmitted power control approach in the radio which uses a CDMA (Code Division Multiple Access: code division multiple access) method, and the mobile station equipment using this approach.
[0002]
[Description of the Prior Art] In a CDMA transmission system, transmitted power control is an indispensable technique. It is because it is necessary to be transmitted from each mobile station in a cel (or sector), and to make equal reception SIR (Signal-to-Interference power Ratio: desired-to-undesired signal power ratio) of each signal received in the base station, and to also make equal reception SIR of the signal which was transmitted from the base station and received with each mobile station, in order to prevent degradation of subscriber capacity.
[0003] There is a channel change method peculiar to CDMA called SHO (Soft HandOver or SoftHandOff) among the CDMA methods. This has the description of starting the communication link with the base station of the SHO point, before the communication link with the base station of a SHO dimension is completed. Namely, a mobile station transmits the signal of the same diffusion code, the same transmit frequencies or a different diffusion code, the same transmit frequencies or the same diffusion code, different transmit frequencies or a different diffusion code, and different transmit frequencies to the base station of a SHO dimension, and the base station of the SHO point, and switches it to a SHO point base station from a SHO yuan base station based on the received power of the signal received independently of each base station. SHO is an approach effective in reduction of the transmitted power of a mobile station and a base station.
[0004] Drawing 1 is a common model Fig. in the case of performing SHO. Here, BS1 is the base station of a SHO dimension, BS2 is the base station of the SHO point, and a mobile station PS 1 transmits a signal (in the case [In the case of the same transmit frequencies only the same diffusion code and :1 wave] of a different diffusion code and different transmit frequencies :2 wave) to BS1 and BS2. On the other hand, each base stations BS1 and BS2 transmit the signal with which the same contents became independent to a mobile station PS 1. In this drawing, a mobile station switches a communications partner to BS2 from BS1.
[0005] Drawing 2 is an example of the transmitted power control system at the time of the conventional SHO. As shown in drawing 1 , when the mobile station PS 1 which is in the cel of a base station BS 1 moves, degradation of the received power of the ball tree channel from a base station BS 1 is detected, and the received power of a set up tree channel starts SHO to highest BS2 in a surrounding cel. The transmitted power control in SHO is controlled by open-loop. That is, transmitted power control of a mobile station PS 1 measures the level of the signal transmitted from each base stations BS1 and BS2 (step S1), and is controlled based on such mobile station receiving level. On the other hand, the transmitted power of each base stations BS1 and BS2 measures the receiving level of the mobile station sending signal in each base station in each base station (step S3, S4), and is controlled based on them

(steps S5 and S6).
[0006]
[Problem(s) to be Solved by the Invention] Since such a conventional method performs transmitted power control in SHO with open-loop, when there is no correlation between going up and the channel from which it gets down, it cannot perform highly precise transmitted power control. For this reason, there was a trouble which causes degradation of subscriber capacity.
[0007] Then, by performing transmitted power control in SHO with high precision, this invention realizes reduction of transmitted power and aims at aiming at the increment in subscriber capacity.
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 In a CDMA system, are the transmitted power control approach in SHO which changes the communication link between a mobile station and a SHO (software handover) Motoki ground office to the communication link between a mobile station and the SHO point, and it sets to said mobile station. In the step which extracts the 1st transmitted power control bit which specifies the transmitted power of said mobile station from said signal transmitted from the SHO yuan base station, and said mobile station In the step which extracts the 2nd transmitted power control bit which specifies the transmitted power of said mobile station from the signal transmitted from said SHO point base station, and said mobile station In the step which measures the transmitted power specified by said 1st transmitted power control bit, and the transmitted power specified by said 2nd transmitted power control bit, and said mobile station In the step which chooses the transmitted power control bit which directs smaller power out of said 1st transmitted power control bit and said 2nd transmitted power control bit, and said mobile station It is characterized by providing the step which controls the transmitted power of this mobile station according to the selected transmitted power control bit.
[0009] Invention according to claim 2 is the transmitted power control approach in SHO which changes the communication link between a mobile station and a SHO yuan base station to the communication link between a mobile station and the SHO point in a CDMA system, and is set to said mobile station. In the step which measures the 1st SIR of said signal transmitted from the SHO yuan base station, and said mobile station In the step which measures the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station In the step which compares said 1st SIR with said 2nd SIR, and said mobile station In the step which chooses bigger SIR out of said 1st SIR and said 2nd SIR, and said mobile station It is characterized by providing the step which determines the transmitted power control bit which directs the transmitted power of said both base stations, and the step which transmits said determined transmitted power control bit to said both base stations from said mobile station according to selected SIR.
[0010] Invention according to claim 3 is characterized by said mobile station performing said SHO using the same diffusion sign, the same transmit frequencies or a different diffusion sign, the same transmit frequencies or the same diffusion sign, different transmit frequencies or a different diffusion sign, and different transmit frequencies to said SHO point base station and said SHO yuan base station in the transmitted power control approach according to claim 1 or 2.
[0011] Invention according to claim 4 is set to a CDMA system according to claim 1. Furthermore, it sets to the step which measures the 1st SIR of said signal transmitted from the SHO yuan base station in said mobile station, and said mobile station. In the step which measures the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station In the step which compares said 1st SIR with said 2nd SIR, and said mobile station In the step which chooses bigger SIR out of said 1st SIR and said 2nd SIR, and said mobile station It is characterized by providing the step which determines the transmitted power control bit which directs the transmitted power of said both base stations, and the step which transmits said determined transmitted power control bit to said both base stations from said mobile station according to selected SIR.
[0012] Invention according to claim 5 is set to a CDMA system. The communication link between SHO yuan base stations A means to extract the 1st transmitted power control bit which specifies the transmitted power of said mobile station from the signal which is equipment of the mobile station which

performs transmitted power control in SHO changed to the communication link between the SHO points, and was transmitted from said SHO yuan base station, A means to extract the 2nd transmitted power control bit which specifies the transmitted power of said mobile station from the signal transmitted from said SHO point base station, A means to measure the transmitted power specified by said 1st transmitted power control bit, and the transmitted power specified by said 2nd transmitted power control bit, It is characterized by providing a means to choose the transmitted power control bit which directs smaller power out of said 1st transmitted power control bit and said 2nd transmitted power control bit, and a means to control the transmitted power of this mobile station according to the selected transmitted power control bit.

[0013] Invention according to claim 6 is set to a CDMA system. The communication link between SHO yuan base stations A means to be equipment of the mobile station which performs transmitted power control in SHO changed to the communication link between the SHO points, and to measure said 1st SIR of the signal transmitted from the SHO yuan base station, In a means to measure the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station A means to compare said 1st SIR with said 2nd SIR, and a means to choose bigger SIR out of said 1st SIR and said 2nd SIR, It is characterized by providing a means to determine the transmitted power control bit which directs the transmitted power of said both base stations, and a means to transmit said determined transmitted power control bit to said both base stations from said mobile station, according to selected SIR.

[0014] Invention according to claim 7 is set to mobile station equipment according to claim 5. Said mobile station Furthermore, a means to measure the 1st SIR of said signal transmitted from the SHO yuan base station, A means to measure the 2nd SIR of the signal transmitted from said SHO point base station, A means to compare said 1st SIR with said 2nd SIR, and a means to choose bigger SIR out of said 1st SIR and said 2nd SIR, It is characterized by providing a means to determine the transmitted power control bit which directs the transmitted power of said both base stations, and a means to transmit said determined transmitted power control bit to said both base stations, according to selected SIR.

[0015]

[Function] When according to this invention transmitted power control is performed into a software handover and the TPC (Transmission Power Control: transmitted power control) bits from the base station of software handover point and software handover origin differ, a mobile station determines the transmitted power of a local station according to directions of the transmitted power control bit which directs smaller transmitted power. Furthermore, when Reception SIR determines the TPC bit for base stations which determines the transmitted power of a base station from the value of the larger one among the mobile station reception SIR from the base station of software handover point and software handover origin, while aiming at reduction of transmitted power, the increment in subscriber capacity is aimed at.

[0016]

[Example] Hereafter, the example of this invention is explained to a detail with reference to a drawing.

[0017] Drawing 3 is the explanatory view showing the 1st approach by this invention. When the mobile station PS 1 is performing SHO to base stations BS1 and BS2, in order to perform transmitted power control by the closed loop, the transmitted power of a mobile station PS 1 is determined by the TPC bit for mobile stations transmitted from each base stations BS1 and BS2.

[0018] That is, a mobile station PS 1 measures the TPC bit for mobile stations from each of base stations BS1 and BS2 in step S11. It is because the TPC bit for mobile stations as which this determines the transmitted power of a mobile station PS 1 is transmitted independently of each base stations BS1 and BS2, so the contents of directions of a TPC bit may differ. In that case, a mobile station PS 1 determines the transmitted power of a mobile station according to the TPC bit of the direction which is directing smaller transmitted power.

[0019] Thus, when according to this invention a mobile station PS 1 separates from the base station BS 1 which is a SHO dimension and approaches the base station BS 2 of the SHO point, the reception SIR in a base station performs transmitted power control of a mobile station PS 1 according to directions of the TPC bit for mobile stations transmitted from the base station of the higher one. Consequently, since according to this invention the reception SIR in the base station BS 1 of a SHO dimension deteriorates, a

channel with a SHO dimension is cut and SHO is completed by this for a short time, reduction of transmitted power is possible. Thus, it is possible by reducing the transmitted power of mobile station PS1 self to become possible to oppress the interferent component to other cels, and to aim at the increment in subscriber capacity.

[0020] Drawing 4 is the explanatory view showing the 2nd approach by this invention. Like the case of drawing 3 , a mobile station PS 1 performs transmitted power control by the closed loop, when SHO is being performed to base stations BS1 and BS2. For this reason, the transmitted power of base stations BS1 and BS2 is determined by the TPC bit for base stations transmitted from a mobile station PS 1. In case the TPC bit for base stations which determines the transmitted power of base stations BS1 and BS2 is determined, since a mobile station PS 1 receives the independent transmission wave from each base stations BS1 and BS2, the reception SIR in a mobile station may differ mutually.

[0021] In drawing 4 , the reception SIR from both base stations BS1 and BS2 is first measured in a mobile station PS 1, respectively. Subsequently, a mobile station PS 1 compares both the measurement result, and determines the TPC bit for base stations according to a value with the larger reception SIR.

[0022] Since the reception SIR with a mobile station PS 1 determines the TPC bit for base stations based on the higher one when according to this invention a mobile station PS 1 separates from the base station BS 1 which is a SHO dimension and approaches the base station BS 2 of the SHO point, the reception SIR from the base station BS 1 of a SHO dimension deteriorates, and a channel with a SHO dimension is cut. Since SHO is completed by this for a short time, reduction of transmitted power is possible. Furthermore, since each base station does not need to transmit the power beyond the need, it does not become a source of interference to other cels, and it can aim at the increment in subscriber capacity.

[0023] Drawing 5 is the explanatory view showing the 3rd approach by this invention. Actual transmitted power control is usually performed in this way. At drawing 5 , as the transmitted power of a mobile station PS 1 was shown in drawing 3 , it determines at steps S11 and S12, and the TPC bit for base stations which directs the transmitted power of base stations BS1 and BS2 is determined at steps S21-S23, as shown in drawing 4 .

[0024] Next, one example of the mobile station equipment by this invention is shown in drawing 6 . In drawing 6 10 the transmission-and-reception separation section and 12 for an antenna and 11 The receiving wireless section, In back-diffusion-of-electrons section, 14, and 14', the recovery section and 15 the TPC bit-select section and 17 for the TPC bit extract section and 16 transmitted power control-section, 18, and 18' [13 and 13'] Wave received-power detecting-element of choice, 19, and 19' arranged at the back-diffusion-of-electrons section 13 and 13', respectively interference wave received-power detecting-element, 20, and 20' arranged at the back-diffusion-of-electrons section 13 and 13', respectively -- for the TPC bit decision section and 23, as for the modulation section and 25, a signal generator and 24 are [the SIR calculation section and 21 / the SIR selection section and 22 / the diffusion section and 26] the transmitting wireless sections.

[0025] Next, actuation of this mobile station equipment is described with reference to drawing 6 . It is received by the antenna 10 and the spread-spectrum signal transmitted from base stations BS1 and BS2 is inputted into the receiving wireless section 12 via the transmission-and-reception separation section 11.

[0026] In the receiving wireless section 12, after an input signal's passing a band-pass filter (BPF:BandPass Filter) and removing a component out of band, it is amplified with amplifier. Frequency conversion of the amplified input signal is carried out to an intermediate frequency band (IF band) by the signal of local-oscillator generating. After BPF passage, after the input signal by which frequency conversion was carried out to IF band is amended by proper signal level, the quasi-synchronous detection of it is carried out by the automatic gain control circuit (AGC:Automatic Gain Control), and frequency conversion is carried out to baseband. After low pass filter (LPF) passage, analog-to-digital conversion (A/D conversion) of the input signal by which frequency conversion was carried out to baseband is carried out, and it turns into a digital signal and is outputted.

[0027] In the back-diffusion-of-electrons section 13 and 13', the back diffusion of electrons of the receiving digital signal outputted from the receiving wireless section 12 is carried out, and it is outputted

as a modulating signal of the narrow-band generated in each base stations BS1 and BS2. In the recovery section 14 and 14', it restores to the signal outputted from the back-diffusion-of-electrons section 13 and 13', respectively.

[0028] Subsequently, in the TPC bit extract section 15, the TPC bit sent from base stations BS1 and BS2 is extracted from each recovery signal. The extracted TPC bit is measured in the TPC bit-select section 16. When TPC bits differ, the TPC bit which directs the smaller transmitted power of a mobile station is chosen, and it is outputted to the transmitted power control section 17. The transmitted power control section 17 determines transmitted power based on the selected TPC bit, and outputs control information to the transmitting wireless section 26.

[0029] On the other hand, the back-diffusion-of-electrons section 13, the wave received-power detecting element 18 of choice in 13' and 18', the interference wave received-power detecting element 19, and 19' detect respectively the wave received power of choice from base stations BS1 and BS2, and the interference wave received power to the wave of choice from each base station. Based on the wave received power of choice and interference wave received power which were detected, the SIR calculation section 20 and 20' ask for the reception SIR of the signal from a base station BS 1, and the reception SIR of the signal from a base station BS 2. The SIR selection section 21 compares the reception SIR of the signal from a base station BS 1 with the reception SIR of the signal from a base station BS 2, and chooses the one where the value of Reception SIR is larger as reception SIR. The value of the selected reception SIR is compared with the target SIR set up beforehand in the transmitted power control-bit decision section 22. When Reception SIR is smaller than Target SIR, the transmitted power control-bit decision section 22 generates the control bit which directs the increment in transmitted power, conversely, when Reception SIR is larger than Target SIR, generates the control bit which directs reduction of transmitted power, and outputs it to a signal generator 23.

[0030] A signal generator 23 constitutes the transmitting frame containing the transmitted power control bit sent from the transmitted power control-bit decision section 22, and outputs it to the modulation section 24. It becomes irregular in the modulation section 24, and after diffusing a sending signal in the diffusion section 25 subsequently, it is outputted to the transmitting wireless section 26. The sending signal by which was transmitting wireless section 26, and set and frequency conversion was carried out to IF and RF band is transmitted with the transmitted power based on the control information outputted from the transmitted power control section 16.

[0031]

[Effect of the Invention] As explained to the detail above, when transmitted power control is performed into a software handover according to this invention, When the TPC bits from the base station of the software handover point and the base station of software handover origin differ, a mobile station While determining the transmitted power of a local station according to directions of the TPC bit which directs smaller transmitted power By determining the TPC bit for base stations among the mobile station reception SIR of the sent signal based on the SIR value of the larger one from the base station of the software handover point, and the base station of software handover origin Since transmitted power by the closed loop is controlled, highly precise transmitted power control is possible. Consequently, while aiming at reduction of transmitted power, the increment in subscriber capacity can be aimed at.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] This invention relates to the transmitted power control approach in the radio which uses a CDMA (Code Division Multiple Access: code division multiple access) method, and the mobile station equipment using this approach.

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PRIOR ART

[Description of the Prior Art] In a CDMA transmission system, transmitted power control is an indispensable technique. It is because it is necessary to be transmitted from each mobile station in a cel (or sector), and to make equal reception SIR (Signal-to-Interference power Ratio: desired-to-undesired signal power ratio) of each signal received in the base station, and to also make equal reception SIR of the signal which was transmitted from the base station and received with each mobile station, in order to prevent degradation of subscriber capacity.
[0003] There is a channel change method peculiar to CDMA called SHO (Soft HandOver or SoftHandOff) among the CDMA methods. This has the description of starting the communication link with the base station of the SHO point, before the communication link with the base station of a SHO dimension is completed. Namely, a mobile station transmits the signal of the same diffusion code, the same transmit frequencies or a different diffusion code, the same transmit frequencies or the same diffusion code, different transmit frequencies or a different diffusion code, and different transmit frequencies to the base station of a SHO dimension, and the base station of the SHO point, and switches it to a SHO point base station from a SHO yuan base station based on the received power of the signal received independently of each base station. SHO is an approach effective in reduction of the transmitted power of a mobile station and a base station.
[0004] Drawing 1 is a common model Fig. in the case of performing SHO. Here, BS1 is the base station of a SHO dimension, BS2 is the base station of the SHO point, and a mobile station PS 1 transmits a signal (in the case [In the case of the same transmit frequencies only the same diffusion code and :1 wave] of a different diffusion code and different transmit frequencies :2 wave) to BS1 and BS2. On the other hand, each base stations BS1 and BS2 transmit the signal with which the same contents became independent to a mobile station PS 1. In this drawing, a mobile station switches a communications partner to BS2 from BS1.
[0005] Drawing 2 is an example of the transmitted power control system at the time of the conventional SHO. As shown in drawing 1 , when the mobile station PS 1 which is in the cel of a base station BS 1 moves, degradation of the received power of the ball tree channel from a base station BS 1 is detected, and the received power of a set up tree channel starts SHO to highest BS2 in a surrounding cel. The transmitted power control in SHO is controlled by open-loop. That is, transmitted power control of a mobile station PS 1 measures the level of the signal transmitted from each base stations BS1 and BS2 (step S1), and is controlled based on such mobile station receiving level. On the other hand, the transmitted power of each base stations BS1 and BS2 measures the receiving level of the mobile station sending signal in each base station in each base station (step S3, S4), and is controlled based on them (steps S5 and S6).

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained to the detail above, when transmitted power control is performed into a software handover in this invention, When the TPC bits from the base station of the software handover point and the base station of software handover origin differ, a mobile station While determining the transmitted power of a local station according to directions of the TPC bit which directs smaller transmitted power Transmitted power by the closed loop is controlled by determining the TPC bit for base stations among the mobile station reception SIR of the sent signal based on the SIR value of the larger one from the base station of the software handover point, and the base station of software handover origin. Therefore, highly precise transmitted power control is possible. Consequently, while aiming at reduction of transmitted power, the increment in subscriber capacity can be aimed at.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since such a conventional method performs transmitted power control in SHO with open-loop, when there is no correlation between going up and the channel from which it gets down, it cannot perform highly precise transmitted power control. For this reason, there was a trouble which causes degradation of subscriber capacity.
[0007] Then, by performing transmitted power control in SHO with high precision, this invention realizes reduction of transmitted power and aims at aiming at the increment in subscriber capacity.

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* NOTICES *

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 In a CDMA system, are the transmitted power control approach in SHO which changes the communication link between a mobile station and a SHO (software handover) Motoki ground office to the communication link between a mobile station and the SHO point, and it sets to said mobile station. In the step which extracts the 1st transmitted power control bit which specifies the transmitted power of said mobile station from said signal transmitted from the SHO yuan base station, and said mobile station In the step which extracts the 2nd transmitted power control bit which specifies the transmitted power of said mobile station from the signal transmitted from said SHO point base station, and said mobile station In the step which measures the transmitted power specified by said 1st transmitted power control bit, and the transmitted power specified by said 2nd transmitted power control bit, and said mobile station In the step which chooses the transmitted power control bit which directs smaller power out of said 1st transmitted power control bit and said 2nd transmitted power control bit, and said mobile station It is characterized by providing the step which controls the transmitted power of this mobile station according to the selected transmitted power control bit.
[0009] Invention according to claim 2 is the transmitted power control approach in SHO which changes the communication link between a mobile station and a SHO yuan base station to the communication link between a mobile station and the SHO point in a CDMA system, and is set to said mobile station. In the step which measures the 1st SIR of said signal transmitted from the SHO yuan base station, and said mobile station In the step which measures the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station In the step which compares said 1st SIR with said 2nd SIR, and said mobile station In the step which chooses bigger SIR out of said 1st SIR and said 2nd SIR, and said mobile station It is characterized by providing the step which determines the transmitted power control bit which directs the transmitted power of said both base stations, and the step which transmits said determined transmitted power control bit to said both base stations from said mobile station according to selected SIR.
[0010] Invention according to claim 3 is characterized by said mobile station performing said SHO using the same diffusion sign, the same transmit frequencies or a different diffusion sign, the same transmit frequencies or the same diffusion sign, different transmit frequencies or a different diffusion sign, and different transmit frequencies to said SHO point base station and said SHO yuan base station in the transmitted power control approach according to claim 1 or 2.
[0011] Invention according to claim 4 is set to a CDMA system according to claim 1. Furthermore, it sets to the step which measures the 1st SIR of said signal transmitted from the SHO yuan base station in said mobile station, and said mobile station. In the step which measures the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station In the step which compares said 1st SIR with said 2nd SIR, and said mobile station In the step which chooses bigger SIR out of said 1st SIR and said 2nd SIR, and said mobile station It is characterized by providing the step which determines the transmitted power control bit which directs the transmitted power of said both base stations, and the step which transmits said determined transmitted power control bit to said both base stations from said

mobile station according to selected SIR.
[0012] Invention according to claim 5 is set to a CDMA system. The communication link between SHO yuan base stations A means to extract the 1st transmitted power control bit which specifies the transmitted power of said mobile station from the signal which is equipment of the mobile station which performs transmitted power control in SHO changed to the communication link between the SHO points, and was transmitted from said SHO yuan base station, A means to extract the 2nd transmitted power control bit which specifies the transmitted power of said mobile station from the signal transmitted from said SHO point base station, A means to measure the transmitted power specified by said 1st transmitted power control bit, and the transmitted power specified by said 2nd transmitted power control bit, It is characterized by providing a means to choose the transmitted power control bit which directs smaller power out of said 1st transmitted power control bit and said 2nd transmitted power control bit, and a means to control the transmitted power of this mobile station according to the selected transmitted power control bit.
[0013] Invention according to claim 6 is set to a CDMA system. The communication link between SHO yuan base stations A means to be equipment of the mobile station which performs transmitted power control in SHO changed to the communication link between the SHO points, and to measure said 1st SIR of the signal transmitted from the SHO yuan base station, In a means to measure the 2nd SIR of the signal transmitted from said SHO point base station, and said mobile station A means to compare said 1st SIR with said 2nd SIR, and a means to choose bigger SIR out of said 1st SIR and said 2nd SIR, It is characterized by providing a means to determine the transmitted power control bit which directs the transmitted power of said both base stations, and a means to transmit said determined transmitted power control bit to said both base stations from said mobile station, according to selected SIR.
[0014] Invention according to claim 7 is set to mobile station equipment according to claim 5. Said mobile station Furthermore, a means to measure the 1st SIR of said signal transmitted from the SHO yuan base station, A means to measure the 2nd SIR of the signal transmitted from said SHO point base station, A means to compare said 1st SIR with said 2nd SIR, and a means to choose bigger SIR out of said 1st SIR and said 2nd SIR, It is characterized by providing a means to determine the transmitted power control bit which directs the transmitted power of said both base stations, and a means to transmit said determined transmitted power control bit to said both base stations, according to selected SIR.

[Translation done.]

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OPERATION

[Function] When according to this invention transmitted power control is performed into a software handover and the TPC (Transmission Power Control: transmitted power control) bits from the base station of software handover point and software handover origin differ, a mobile station determines the transmitted power of a local station according to directions of the transmitted power control bit which directs smaller transmitted power. Furthermore, when Reception SIR determines the TPC bit for base stations which determines the transmitted power of a base station from the value of the larger one among the mobile station reception SIR from the base station of software handover point and software handover origin, while aiming at reduction of transmitted power, the increment in subscriber capacity is aimed at.

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EXAMPLE

[Example] Hereafter, the example of this invention is explained to a detail with reference to a drawing.
[0017] Drawing 3 is the explanatory view showing the 1st approach by this invention. When the mobile station PS 1 is performing SHO to base stations BS1 and BS2, in order to perform transmitted power control by the closed loop, the transmitted power of a mobile station PS 1 is determined by the TPC bit for mobile stations transmitted from each base stations BS1 and BS2.
[0018] That is, a mobile station PS 1 measures the TPC bit for mobile stations from each of base stations BS1 and BS2 in step S11. It is because the TPC bit for mobile stations as which this determines the transmitted power of a mobile station PS 1 is transmitted independently of each base stations BS1 and BS2, so the contents of directions of a TPC bit may differ. In that case, a mobile station PS 1 determines the transmitted power of a mobile station according to the TPC bit of the direction which is directing smaller transmitted power.
[0019] Thus, when according to this invention a mobile station PS 1 separates from the base station BS 1 which is a SHO dimension and approaches the base station BS 2 of the SHO point, the reception SIR in a base station performs transmitted power control of a mobile station PS 1 according to directions of the TPC bit for mobile stations transmitted from the base station of the higher one. Consequently, since according to this invention the reception SIR in the base station BS 1 of a SHO dimension deteriorates, a channel with a SHO dimension is cut and SHO is completed by this for a short time, reduction of transmitted power is possible. Thus, it is possible by reducing the transmitted power of mobile station PS1 self to become possible to oppress the interferent component to other cels, and to aim at the increment in subscriber capacity.
[0020] Drawing 4 is the explanatory view showing the 2nd approach by this invention. Like the case of drawing 3 , a mobile station PS 1 performs transmitted power control by the closed loop, when SHO is being performed to base stations BS1 and BS2. For this reason, the transmitted power of base stations BS1 and BS2 is determined by the TPC bit for base stations transmitted from a mobile station PS 1. In case the TPC bit for base stations which determines the transmitted power of base stations BS1 and BS2 is determined, since a mobile station PS 1 receives the independent transmission wave from each base stations BS1 and BS2, the reception SIR in a mobile station may differ mutually.
[0021] In drawing 4 , the reception SIR from both base stations BS1 and BS2 is first measured in a mobile station PS 1, respectively. Subsequently, a mobile station PS 1 compares both the measurement result, and determines the TPC bit for base stations according to a value with the larger reception SIR.
[0022] Since the reception SIR with a mobile station PS 1 determines the TPC bit for base stations based on the higher one when according to this invention a mobile station PS 1 separates from the base station BS 1 which is a SHO dimension and approaches the base station BS 2 of the SHO point, the reception SIR from the base station BS 1 of a SHO dimension deteriorates, and a channel with a SHO dimension is cut. Since SHO is completed by this for a short time, reduction of transmitted power is possible. Furthermore, since each base station does not need to transmit the power beyond the need, it does not become a source of interference to other cels, and it can aim at the increment in subscriber capacity.
[0023] Drawing 5 is the explanatory view showing the 3rd approach by this invention. Actual

transmitted power control is usually performed in this way. At drawing 5 , as the transmitted power of a mobile station PS 1 was shown in drawing 3 , it determines at steps S11 and S12, and the TPC bit for base stations which directs the transmitted power of base stations BS1 and BS2 is determined at steps S21-S23, as shown in drawing 4 .

[0024] Next, one example of the mobile station equipment by this invention is shown in drawing 6 . In drawing 6 10 the transmission-and-reception separation section and 12 for an antenna and 11 The receiving wireless section, In back-diffusion-of-electrons section, 14, and 14', the recovery section and 15 the TPC bit-select section and 17 for the TPC bit extract section and 16 transmitted power control-section, 18, and 18' [13 and 13'] Wave received-power detecting-element of choice, 19, and 19' arranged at the back-diffusion-of-electrons section 13 and 13', respectively.interference wave received-power detecting-element, 20, and 20' arranged at the back-diffusion-of-electrons section 13 and 13', respectively -- for the TPC bit decision section and 23, as for the modulation section and 25, a signal generator and 24 are [the SIR calculation section and 21 / the SIR selection section and 22 / the diffusion section and 26] the transmitting wireless sections.

[0025] Next, actuation of this mobile station equipment is described with reference to drawing 6 . It is received by the antenna 10 and the spread-spectrum signal transmitted from base stations BS1 and BS2 is inputted into the receiving wireless section 12 via the transmission-and-reception separation section 11.

[0026] In the receiving wireless section 12, after an input signal's passing a band-pass filter (BPF:BandPass Filter) and removing a component out of band, it is amplified with amplifier. Frequency conversion of the amplified input signal is carried out to an intermediate frequency band (IF band) by the signal of local-oscillator generating. After BPF passage, after the input signal by which frequency conversion was carried out to IF band is amended by proper signal level, the quasi-synchronous detection of it is carried out by the automatic gain control circuit (AGC:Automatic Gain Control), and frequency conversion is carried out to baseband. After low pass filter (LPF) passage, analog-to-digital conversion (A/D conversion) of the input signal by which frequency conversion was carried out to baseband is carried out, and it turns into a digital signal and is outputted.

[0027] In the back-diffusion-of-electrons section 13 and 13', the back diffusion of electrons of the receiving digital signal outputted from the receiving wireless section 12 is carried out, and it is outputted as a modulating signal of the narrow-band generated in each base stations BS1 and BS2. In the recovery section 14 and 14', it restores to the signal outputted from the back-diffusion-of-electrons section 13 and 13', respectively.

[0028] Subsequently, in the TPC bit extract section 15, the TPC bit sent from base stations BS1 and BS2 is extracted from each recovery signal. The extracted TPC bit is measured in the TPC bit-select section 16. When TPC bits differ, the TPC bit which directs the smaller transmitted power of a mobile station is chosen, and it is outputted to the transmitted power control section 17. The transmitted power control section 17 determines transmitted power based on the selected TPC bit, and outputs control information to the transmitting wireless section 26.

[0029] On the other hand, the back-diffusion-of-electrons section 13, the wave received-power detecting element 18 of choice in 13' and 18', the interference wave received-power detecting element 19, and 19' detect respectively the wave received power of choice from base stations BS1 and BS2, and the interference wave received power to the wave of choice from each base station. Based on the wave received power of choice and interference wave received power which were detected, the SIR calculation section 20 and 20' ask for the reception SIR of the signal from a base station BS 1, and the reception SIR of the signal from a base station BS 2. The SIR selection section 21 compares the reception SIR of the signal from a base station BS 1 with the reception SIR of the signal from a base station BS 2, and chooses the one where the value of Reception SIR is larger as reception SIR. The value of the selected reception SIR is compared with the target SIR set up beforehand in the transmitted power control-bit decision section 22. When Reception SIR is smaller than Target SIR, the transmitted power control-bit decision section 22 generates the control bit which directs the increment in transmitted power, conversely, when Reception SIR is larger than Target SIR, generates the control bit which directs

reduction of transmitted power, and outputs it to a signal generator 23.
[0030] A signal generator 23 constitutes the transmitting frame containing the transmitted power control bit sent from the transmitted power control-bit decision section 22, and outputs it to the modulation section 24. It becomes irregular in the modulation section 24, and after diffusing a sending signal in the diffusion section 25 subsequently, it is outputted to the transmitting wireless section 26. The sending signal by which was transmitting wireless section 26, and set and frequency conversion was carried out to IF and RF band is transmitted with the transmitted power based on the control information outputted from the transmitted power control section 16.

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DESCRIPTION OF DRAWINGS

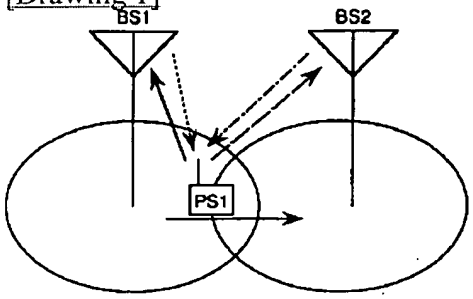
[Brief Description of the Drawings]
[Drawing 1] It is a common model Fig. in the case of performing SHO.
[Drawing 2] It is the explanatory view of the conventional transmitted power control system.
[Drawing 3] It is the explanatory view of the 1st transmitted power control approach by this invention.
[Drawing 4] It is the explanatory view of the 2nd transmitted power control approach by this invention.
[Drawing 5] It is the explanatory view of the 3rd transmitted power control approach by this invention.
[Drawing 6] It is the block diagram showing one example of the mobile station equipment which applied the 3rd transmitted power control approach by this invention.
[Description of Notations]
PS1 Mobile station
BS1 Base station of a SHO dimension
BS2 Base station of the SHO point
10 Antenna
11 Transmission-and-Reception Separation Section
12 Receiving Wireless Section
13 13' Back-diffusion-of-electrons section
14 14' Recovery section
15 TPC Bit Extract Section
16 TPC Bit-Select Section
17 Transmitted Power Control Section
18 18' Wave received-power detecting element of choice
19 19' Interference wave received-power detecting element
20 20' SIR calculation section
21 SIR Selection Section
22 TPC Bit Decision Section
23 Signal Generator
24 Modulation Section
25 Diffusion Section
26 Transmitting Wireless Section

[Translation done.]

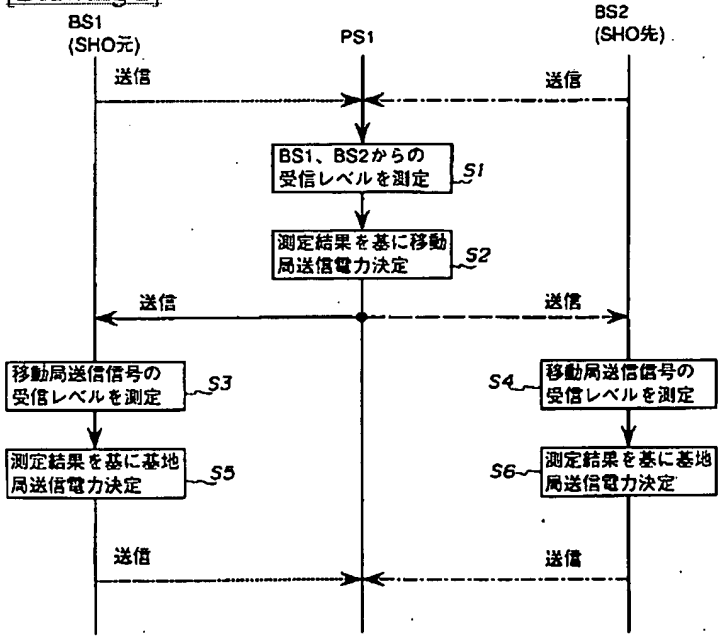
* NOTICES *

DRAWINGS

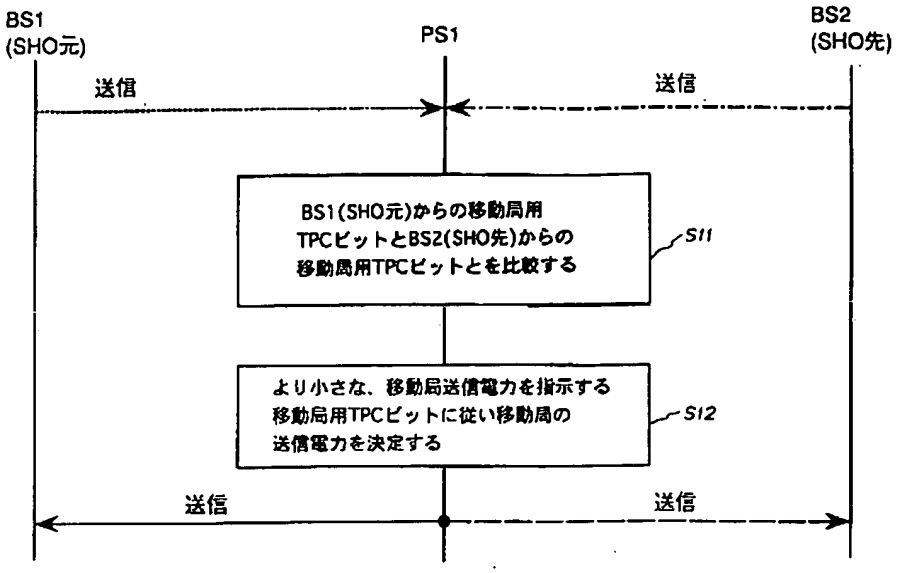
[Drawing 1]



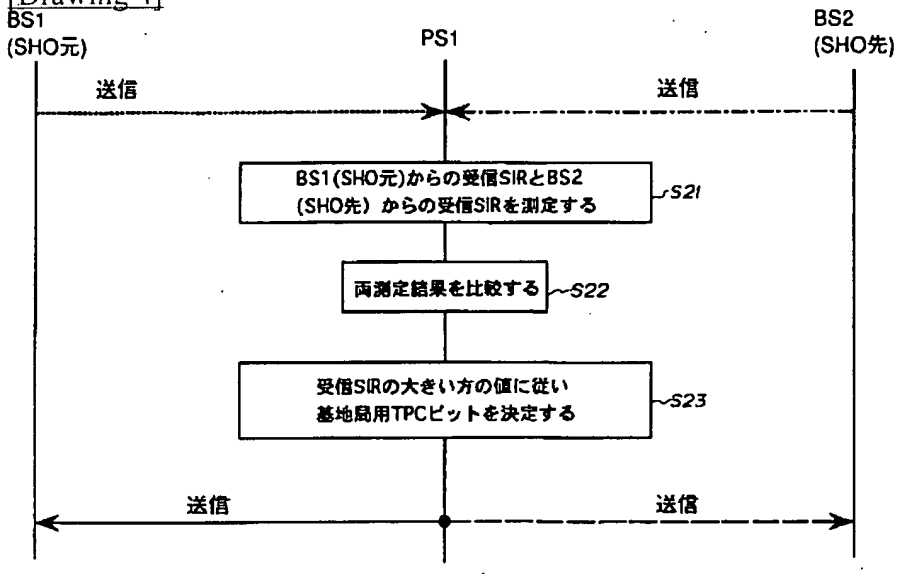
[Drawing 2]



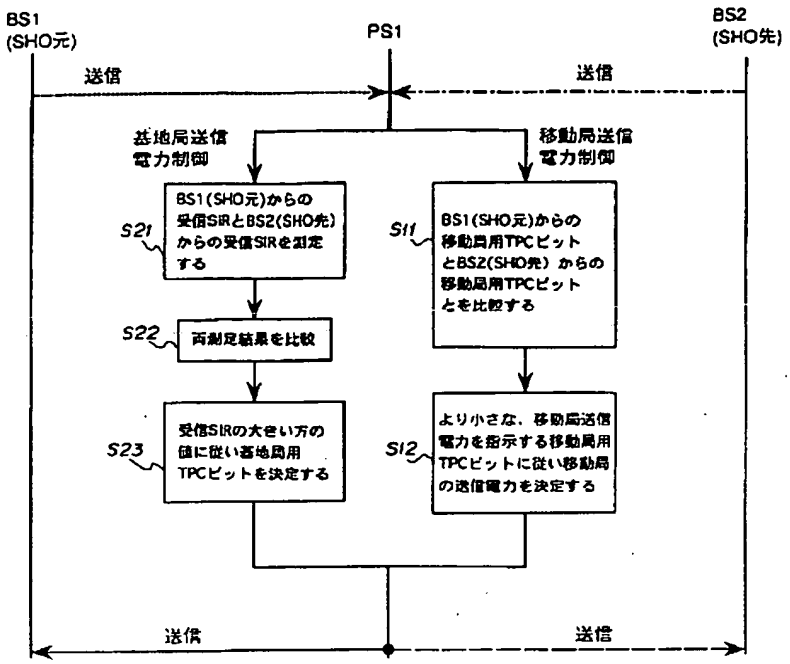
[Drawing 3]



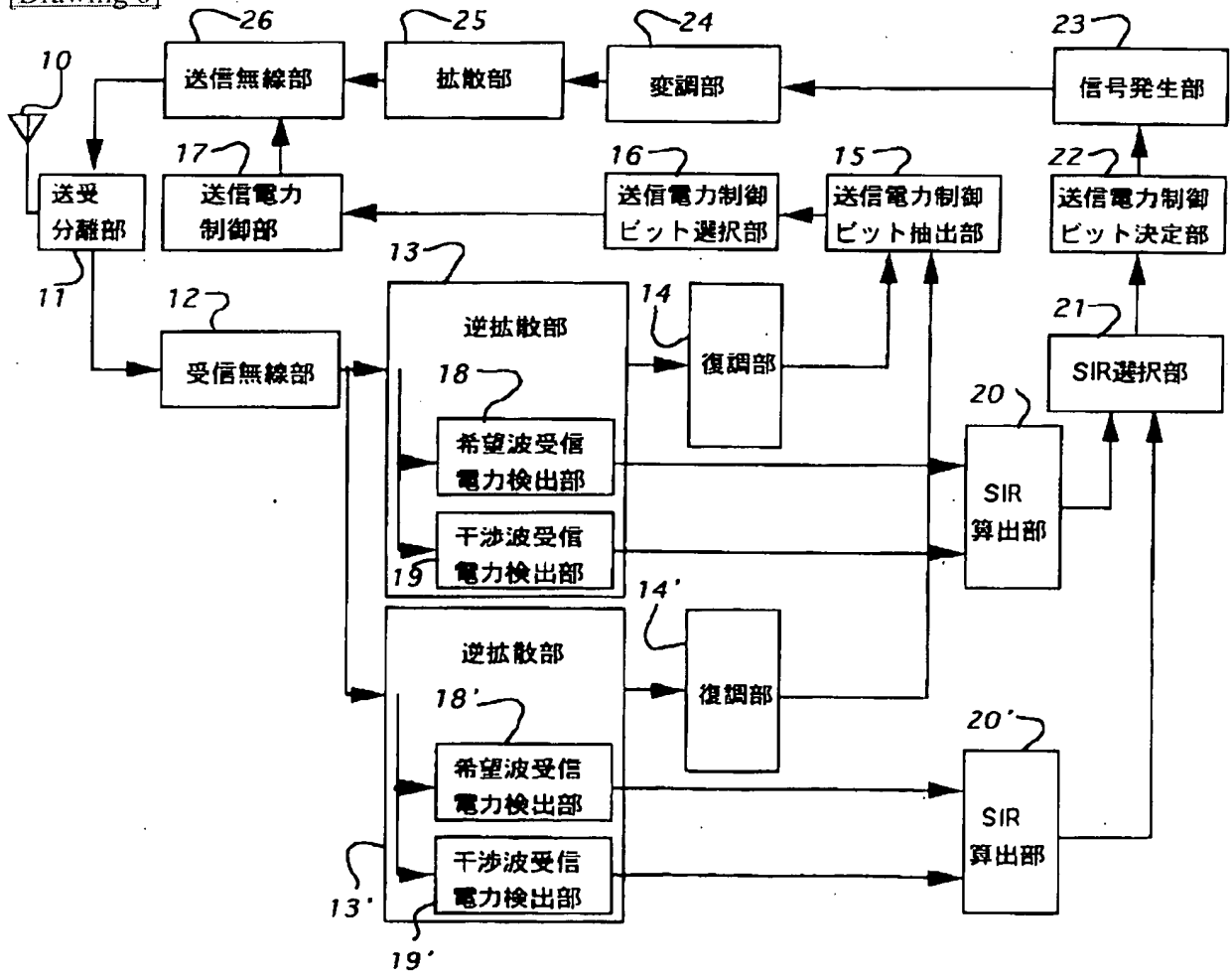
[Drawing 4]



[Drawing 5]


BS1
(SHO元)
PS1
BS2
(SHO先)
送信
送信
基地局送信
電力制御
移動局送信
電力制御
S21
BS1(SHO元)からの
受信SIRとBS2(SHO先)
からの受信SIRを測定
する
S11
BS1(SHO元)からの
移動局用TPCビット
とBS2(SHO先)からの
移動局用TPCビット
とを比較する
S22
両測定結果を比較
S23
受信SIRの大きい方の
値に従い基地局用
TPCビットを決定する
S12
より小さな、移動局送信
電力を指示する移動局用
TPCビットに従い移動局
の送信電力を決定する
送信
送信

[Drawing 6]


10
26
送信無線部
25
拡散部
24
変調部
23
信号発生部
17
送信電力
制御部
16
送信電力制御
ビット選択部
15
送信電力制御
ビット抽出部
22
送信電力制御
ビット決定部
送受
分離部
11
12
受信無線部
13
逆拡散部
18
希望波受信
電力検出部
干渉波受信
電力検出部
19
14
復調部
21
SIR選択部
20
SIR
算出部
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18'
希望波受信
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SIR
算出部

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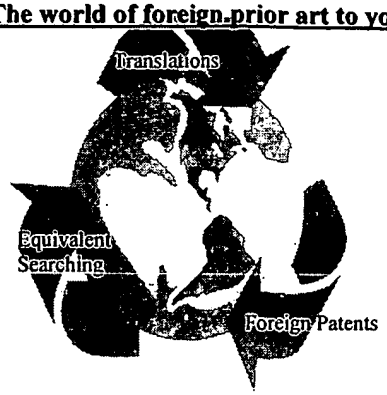

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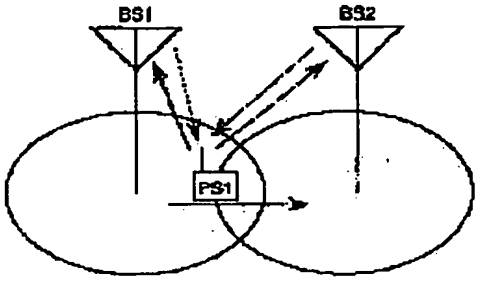
(54) TRANSMISSION POWER CONTROL METHOD AND MOBILE STATION EQUIPMENT

(57)Abstract:
PURPOSE: To attain highly precise transmission power control by allowing a mobile station to select a transmission power control bit representing a smaller power among transmission power control bits and to control transmission power of the mobile station according to the selected control bit.
CONSTITUTION: When a mobile station PS1 makes SHO (software hand-over) for base stations BS1, BS2, the transmission power of the mobile station PS1 is decided by a mobile station use TPC (transmission power) bit sent from each of the base stations BS1, BS2. That is, the mobile station PS1 compares the mobile station use TPC bits from the base stations BS1, BS2. In this case, the mobile station PS1 decides the transmission power of the mobile station according to the TPC bit representing a smaller transmission power. As a result, a reception SIR (desired wave versus interference wave power ratio) in the base station BS1 being a source SHO is deteriorated and a channel with the source SHO is interrupted and the SHO is terminated in a short time, then the transmission power is reduced.



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			Ｈ０４Ｊ　13/ 00　Ｆ	

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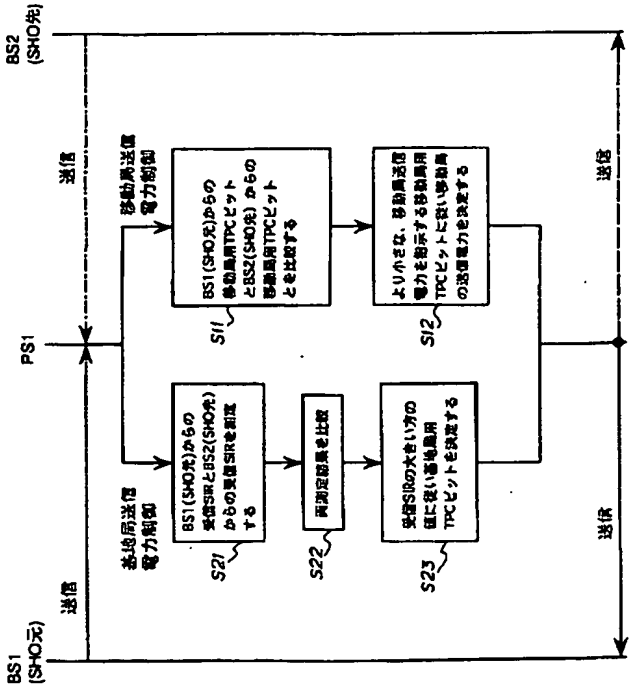
最終頁に続く

(54)【発明の名称】　送信電力制御方法および移動局装置

(57)【要約】

【目的】　ＳＨＯ中の送信電力制御を高精度に行うことにより、送信電力の低減を実現し、以て加入者容量の増加を図る。

【構成】　ソフトハンドオーバ中に送信電力制御を行う場合、ソフトハンドオーバ先、ソフトハンドオーバ元の基地局からのＴＰＣ（ＴｒａｎｓｍｉｓｓｉｏｎＰｏｗｅｒ　Ｃｏｎｔｒｏｌ：送信電力制御）ビットが異なった場合に、より小さな移動局送信電力を指示するＴＰＣビットの指示に従って、移動局の送信電力を決定するとともに、ソフトハンドオーバ先、ソフトハンドオーバ元の基地局からの移動局受信ＳＩＲのうち、受信ＳＩＲが大きい方の値から、基地局送信電力制御用ＴＰＣビットを決定することにより、送信電力の低減を図ると共に、加入者容量の増加を図る。



【特許請求の範囲】

【請求項１】　ＣＤＭＡシステムにおいて、移動局とＳＨＯ（ソフトハンドオーバ）元基地局との間の通信を、移動局とＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御方法であって、

前記移動局において、前記ＳＨＯ元基地局から送信された信号から、前記移動局の送信電力を指定する第１の送信電力制御ビットを抽出するステップと、

前記移動局において、前記ＳＨＯ先基地局から送信された信号から、前記移動局の送信電力を指定する第２の送信電力制御ビットを抽出するステップと、

前記移動局において、前記第１の送信電力制御ビットが指定する送信電力と、前記第２の送信電力制御ビットが指定する送信電力とを比較するステップと、

前記移動局において、前記第１の送信電力制御ビットおよび前記第２の送信電力制御ビットの中から、より小さな電力を指示する送信電力制御ビットを選択するステップと、

前記移動局において、選択された送信電力制御ビットに従って、該移動局の送信電力を制御するステップとを具備することを特徴とする送信電力制御方法。

【請求項２】　ＣＤＭＡシステムにおいて、移動局とＳＨＯ元基地局との間の通信を、移動局とＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御方法であって、

前記移動局において、前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定するステップと、

前記移動局において、前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定するステップと、

前記移動局において、前記第１のＳＩＲと、前記第２のＳＩＲとを比較するステップと、

前記移動局において、前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択するステップと、

前記移動局において、選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定するステップと、

前記決定された送信電力制御ビットを、前記移動局から前記両基地局に送信するステップとを具備することを特徴とする送信電力制御方法。

【請求項３】　前記移動局は、前記ＳＨＯ先基地局と、前記ＳＨＯ元基地局に対して、同一拡散符号、同一送信周波数、または異拡散符号、同一送信周波数、または同一拡散符号、異送信周波数、または異拡散符号、異送信周波数を用いて前記ＳＨＯを行うことを特徴とする請求項１または２に記載の送信電力制御方法。

【請求項４】　請求項１に記載のＣＤＭＡシステムにおいて、さらに、

前記移動局において、前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定するステップと、

前記移動局において、前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定するステップと、

前記移動局において、前記第１のＳＩＲと、前記第２のＳＩＲとを比較するステップと、

前記移動局において、前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択するステップと、

前記移動局において、選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定するステップと、

前記決定された送信電力制御ビットを、前記移動局から前記両基地局に送信するステップとを具備することを特徴とする送信電力制御方法。

【請求項５】　ＣＤＭＡシステムにおいて、ＳＨＯ元基地局との間の通信を、ＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御を行う移動局の装置であって、

前記ＳＨＯ元基地局から送信された信号から、前記移動局の送信電力を指定する第１の送信電力制御ビットを抽出する手段と、

前記ＳＨＯ先基地局から送信された信号から、前記移動局の送信電力を指定する第２の送信電力制御ビットを抽出する手段と、

前記第１の送信電力制御ビットが指定する送信電力と、前記第２の送信電力制御ビットが指定する送信電力とを比較する手段と、

前記第１の送信電力制御ビットおよび前記第２の送信電力制御ビットの中から、より小さな電力を指示する送信電力制御ビットを選択する手段と、

選択された送信電力制御ビットに従って、該移動局の送信電力を制御する手段とを具備することを特徴とする移動局装置。

【請求項６】　ＣＤＭＡシステムにおいて、ＳＨＯ元基地局との間の通信を、ＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御を行う移動局の装置であって、

前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定する手段と、

前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定する手段と、

前記移動局において、前記第１のＳＩＲと、前記第２のＳＩＲとを比較する手段と、

前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択する手段と、

選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定する手段と、

前記決定された送信電力制御ビットを、前記移動局から前記両基地局に送信する手段とを具備することを特徴とする移動局装置。

【請求項７】　前記移動局装置は、さらに、

前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定する手段と、
前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定する手段と、
前記第１のＳＩＲと、前記第２のＳＩＲとを比較する手段と、
前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択する手段と、
選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定する手段と、
前記決定された送信電力制御ビットを、前記両基地局に送信する手段とを具備することを特徴とする請求項５に記載の移動局装置。
【請求項８】　前記移動局装置は、前記ＳＨＯ先基地局と、前記ＳＨＯ元基地局に対して、同一拡散符号、同一送信周波数、または異拡散符号、同一送信周波数、または同一拡散符号、異送信周波数、または異拡散符号、異送信周波数を用いて前記ＳＨＯを行うことを特徴とする請求項５，６または７に記載の移動局装置。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明はＣＤＭＡ（Ｃｏｄｅ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ：符号分割多元接続）方式を用いる無線通信における、送信電力制御方法およびこの方法を用いた移動局装置に関するものである。
【０００２】
【従来の技術】ＣＤＭＡ伝送方式においては、送信電力制御は必須の技術である。それは、加入者容量の劣化を防ぐために、セル（またはセクタ）内の各移動局から送信され、基地局において受信された各信号の受信ＳＩＲ（Ｓｉｇｎａｌ－ｔｏ－Ｉｎｔｅｒｆｅｒｅｎｃｅ ｐｏｗｅｒ Ｒａｔｉｏ：希望波対干渉波電力比）を等しくする必要があり、また、基地局から送信され、各移動局で受信された信号の受信ＳＩＲも等しくする必要があるためである。
【０００３】ＣＤＭＡ方式には、ＳＨＯ（Ｓｏｆｔ ＨａｎｄＯｖｅｒ、またはＳｏｆｔＨａｎｄＯｆｆ）と呼ばれる、ＣＤＭＡ独特のチャネル切り替え方式がある。これは、ＳＨＯ元の基地局との通信が終了する前に、ＳＨＯ先の基地局との通信を開始するという特徴がある。すなわち、移動局は、ＳＨＯ元の基地局とＳＨＯ先の基地局とに対して同一拡散コード、同一送信周波数、または異拡散コード、同一送信周波数、または同一拡散コード、異送信周波数、または異拡散コード、異送信周波数の信号を送信し、各基地局から独立に受信した信号の受信電力に基づいて、ＳＨＯ元基地局からＳＨＯ先基地局に切り換える。ＳＨＯは、移動局、基地局の送信電力の低減に有効な方法である。
【０００４】図１は、ＳＨＯを行う場合の一般的モデル図である。ここで、ＢＳ１はＳＨＯ元の基地局、ＢＳ２はＳＨＯ先の基地局であり、移動局ＰＳ１はＢＳ１およびＢＳ２に対して、信号（同一拡散コード、同一送信周波数の場合：１波のみ、異拡散コード、異送信周波数の場合：２波）を送信する。一方、各基地局ＢＳ１およびＢＳ２は、同一内容の独立した信号を移動局ＰＳ１に対して送信する。この図では、移動局は、通信相手をＢＳ１からＢＳ２に切り換える。
【０００５】図２は、従来のＳＨＯ時の送信電力制御方式の一例である。基地局ＢＳ１のセル内にいる移動局ＰＳ１が、図１に示すように移動する場合に、基地局ＢＳ１からのとまり木チャネルの受信電力の劣化を検出し、周辺のセルの中で、とまり木チャネルの受信電力が最も高いＢＳ２に対して、ＳＨＯを開始する。ＳＨＯ中の送信電力制御は、オープンループで制御される。すなわち、移動局ＰＳ１の送信電力制御は、各基地局ＢＳ１およびＢＳ２から送信された信号のレベルを測定し（ステップＳ１）、これらの移動局受信レベルに基づいて制御される。一方、各基地局ＢＳ１およびＢＳ２の送信電力は、各基地局における移動局送信信号の受信レベルを各基地局で測定し（ステップＳ３、Ｓ４）、それらに基づいて制御される（ステップＳ５、Ｓ６）。
【０００６】
【発明が解決しようとする課題】このような従来方式は、ＳＨＯ中の送信電力制御をオープンループで行うので、上りと下りのチャネル間に相関がない場合には、高精度の送信電力制御ができない。このため、加入者容量の劣化を引き起こす問題点があった。
【０００７】そこで、本発明は、ＳＨＯ中の送信電力制御を高精度に行うことにより送信電力の低減を実現し、加入者容量の増加を図ることを目的とする。
【０００８】
【課題を解決するための手段】上記目的を達成するために、請求項１に記載の発明は、ＣＤＭＡシステムにおいて、移動局とＳＨＯ（ソフトハンドオーバ）元基地局との間の通信を、移動局とＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御方法であって、前記移動局において、前記ＳＨＯ元基地局から送信された信号から、前記移動局の送信電力を指定する第１の送信電力制御ビットを抽出するステップと、前記移動局において、前記ＳＨＯ先基地局から送信された信号から、前記移動局の送信電力を指定する第２の送信電力制御ビットを抽出するステップと、前記移動局において、前記第１の送信電力制御ビットが指定する送信電力と、前記第２の送信電力制御ビットが指定する送信電力とを比較するステップと、前記移動局において、前記第１の送信電力制御ビットおよび前記第２の送信電力制御ビットの中から、より小さな電力を指示する送信電力制御ビットを選択するステップと、前記移動局において、選択された送信電力制御ビットに従って、該移動局の送信電力を制御する

ステップとを具備することを特徴とする。

【０００９】請求項２に記載の発明は、ＣＤＭＡシステムにおいて、移動局とＳＨＯ元基地局との間の通信を、移動局とＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御方法であって、前記移動局において、前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定するステップと、前記移動局において、前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定するステップと、前記移動局において、前記第１のＳＩＲと、前記第２のＳＩＲとを比較するステップと、前記移動局において、前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択するステップと、前記移動局において、選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定するステップと、前記決定された送信電力制御ビットを、前記移動局から前記両基地局に送信するステップとを具備することを特徴とする。

【００１０】請求項３に記載の発明は、請求項１または２に記載の送信電力制御方法において、前記移動局は、前記ＳＨＯ先基地局と、前記ＳＨＯ元基地局に対して、同一拡散符号、同一送信周波数、または異拡散符号、同一送信周波数、または同一拡散符号、異送信周波数、または異拡散符号、異送信周波数を用いて前記ＳＨＯを行うことを特徴とする。

【００１１】請求項４に記載の発明は、請求項１に記載のＣＤＭＡシステムにおいて、さらに、前記移動局において、前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定するステップと、前記移動局において、前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定するステップと、前記移動局において、前記第１のＳＩＲと、前記第２のＳＩＲとを比較するステップと、前記移動局において、前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択するステップと、前記移動局において、選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定するステップと、前記決定された送信電力制御ビットを、前記移動局から前記両基地局に送信するステップとを具備することを特徴とする。

【００１２】請求項５に記載の発明は、ＣＤＭＡシステムにおいて、ＳＨＯ元基地局との間の通信を、ＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御を行う移動局の装置であって、前記ＳＨＯ元基地局から送信された信号から、前記移動局の送信電力を指定する第１の送信電力制御ビットを抽出する手段と、前記ＳＨＯ先基地局から送信された信号から、前記移動局の送信電力を指定する第２の送信電力制御ビットを抽出する手段と、前記第１の送信電力制御ビットが指定する送信電力と、前記第２の送信電力制御ビットが指定する送信電力とを比較する手段と、前記第１の送信電力制御ビットおよび前記第２の送信電力制御ビットの中から、より小さな電力を指示する送信電力制御ビットを選択する手段と、選択された送信電力制御ビットに従って、該移動局の送信電力を制御する手段とを具備することを特徴とする。

【００１３】請求項６に記載の発明は、ＣＤＭＡシステムにおいて、ＳＨＯ元基地局との間の通信を、ＳＨＯ先との間の通信に切り替えるＳＨＯ中の送信電力制御を行う移動局の装置であって、前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定する手段と、前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定する手段と、前記移動局において、前記第１のＳＩＲと、前記第２のＳＩＲとを比較する手段と、前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択する手段と、選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定する手段と、前記決定された送信電力制御ビットを、前記移動局から前記両基地局に送信する手段とを具備することを特徴とする。

【００１４】請求項７に記載の発明は、請求項５に記載の移動局装置において、前記移動局は、さらに、前記ＳＨＯ元基地局から送信された信号の第１のＳＩＲを測定する手段と、前記ＳＨＯ先基地局から送信された信号の第２のＳＩＲを測定する手段と、前記第１のＳＩＲと、前記第２のＳＩＲとを比較する手段と、前記第１のＳＩＲと前記第２のＳＩＲの中から、より大きなＳＩＲを選択する手段と、選択されたＳＩＲに従って、前記両基地局の送信電力を指示する送信電力制御ビットを決定する手段と、前記決定された送信電力制御ビットを、前記両基地局に送信する手段とを具備することを特徴とする。

【００１５】

【作用】本発明によれば、ソフトハンドオーバ中に送信電力制御を行う場合、ソフトハンドオーバ先、ソフトハンドオーバ元の基地局からのＴＰＣ（Ｔｒａｎｓｍｉｓｓｉｏｎ　Ｐｏｗｅｒ　Ｃｏｎｔｒｏｌ：送信電力制御）ビットが異なった場合に、移動局は、より小さな送信電力を指示する送信電力制御ビットの指示に従って、自局の送信電力を決定する。さらに、ソフトハンドオーバ先、ソフトハンドオーバ元の基地局からの移動局受信ＳＩＲのうち、受信ＳＩＲが大きい方の値から基地局の送信電力を決定する基地局用ＴＰＣビットを決定することにより、送信電力の低減を図ると共に、加入者容量の増加を図る。

【００１６】

【実施例】以下、図面を参照して本発明の実施例を詳細に説明する。

【００１７】図３は、本発明による第１の方法を示す説明図である。移動局ＰＳ１が、基地局ＢＳ１およびＢＳ２に対してＳＨＯを行っている場合、クローズドループで送信電力制御を行うため、移動局ＰＳ１の送信電力は、各基地局ＢＳ１およびＢＳ２から送信される移動局

用ＴＰＣビットにより決定される。

【００１８】すなわち、移動局ＰＳ１は、ステップＳ１１において、基地局ＢＳ１およびＢＳ２の各々からの移動局用ＴＰＣビットを比較する。これは、移動局ＰＳ１の送信電力を決定する移動局用ＴＰＣビットは、各基地局ＢＳ１およびＢＳ２から独立して送信されるので、ＴＰＣビットの指示内容が異なる場合があるからである。その場合、移動局ＰＳ１は、より小さな送信電力を指示している方のＴＰＣビットに従って、移動局の送信電力を決定する。

【００１９】このように、本発明によれば、移動局ＰＳ１がＳＨＯ元の基地局ＢＳ１から離れ、ＳＨＯ先の基地局ＢＳ２に近づく場合に、基地局での受信ＳＩＲが高い方の基地局から送信された移動局用ＴＰＣビットの指示に従って、移動局ＰＳ１の送信電力制御を行なう。その結果、本発明によれば、ＳＨＯ元の基地局ＢＳ１での受信ＳＩＲが劣化して、ＳＨＯ元とのチャネルが切断され、これによりＳＨＯが短時間に完了するので、送信電力の低減が可能である。このように、移動局ＰＳ１自身の送信電力を低減することにより、他セルに対する干渉成分を抑圧することが可能となり、加入者容量の増加を図ることが可能である。

【００２０】図４は、本発明による第２の方法を示す説明図である。図３の場合と同様に、移動局ＰＳ１は、基地局ＢＳ１、ＢＳ２に対してＳＨＯを行っている場合に、クローズドループで送信電力制御を行う。このため、基地局ＢＳ１およびＢＳ２の送信電力は、移動局ＰＳ１から送信される基地局用ＴＰＣビットにより決定される。基地局ＢＳ１およびＢＳ２の送信電力を決定する基地局用ＴＰＣビットを決定する際に、移動局ＰＳ１は、各基地局ＢＳ１およびＢＳ２からの独立の送信波を受信するので、移動局における受信ＳＩＲは、互いに異なる可能性がある。

【００２１】図４においては、まず、移動局ＰＳ１において、双方の基地局ＢＳ１およびＢＳ２からの受信ＳＩＲをそれぞれ測定する。次いで、移動局ＰＳ１は、両測定結果を比較し、受信ＳＩＲの大きい方の値に従って、基地局用ＴＰＣビットを決定する。

【００２２】本発明によれば、移動局ＰＳ１がＳＨＯ元の基地局ＢＳ１から離れ、ＳＨＯ先の基地局ＢＳ２に近づく場合に、移動局ＰＳ１での受信ＳＩＲが高い方を基に、基地局用ＴＰＣビットを決定するので、ＳＨＯ元の基地局ＢＳ１からの受信ＳＩＲが劣化し、ＳＨＯ元とのチャネルが切断される。これにより、ＳＨＯが短時間に完了するので、送信電力の低減が可能である。さらに、各基地局は、必要以上の電力を送信しないですむので、他セルに対する干渉源となることがなく、加入者容量の増加を図ることが可能である。

【００２３】図５は、本発明による第３の方法を示す説明図である。実際の送信電力制御は、通常、このように行われる。図５では、移動局ＰＳ１の送信電力は、図３に示したように、ステップＳ１１およびＳ１２で決定し、基地局ＢＳ１およびＢＳ２の送信電力を指示する基地局用ＴＰＣビットは、図４に示したように、ステップＳ２１～Ｓ２３で決定する。

【００２４】次に、本発明による移動局装置の一実施例を図６に示す。図６において、１０はアンテナ、１１は送受分離部、１２は受信無線部、１３および１３′は逆拡散部、１４および１４′は復調部、１５はＴＰＣビット抽出部、１６はＴＰＣビット選択部、１７は送信電力制御部、１８および１８′は、それぞれ、逆拡散部１３および１３′に配置された希望波受信電力検出部、１９および１９′は、それぞれ、逆拡散部１３および１３′に配置された干渉波受信電力検出部、２０および２０′はＳＩＲ算出部、２１はＳＩＲ選択部、２２はＴＰＣビット決定部、２３は信号発生部、２４は変調部、２５は拡散部、および２６は送信無線部である。

【００２５】次に、図６を参照して、本移動局装置の動作について述べる。基地局ＢＳ１およびＢＳ２から送信されたスペクトル拡散信号は、アンテナ１０で受信され、送受分離部１１を経由し、受信無線部１２に入力される。

【００２６】受信無線部１２において、受信信号は、帯域通過フィルタ（ＢＰＦ：ＢａｎｄＰａｓｓ　Ｆｉｌｔｅｒ）を通過し、帯域外成分を除去された後、増幅器で増幅される。増幅された受信信号は、局部発振器発生の信号により中間周波数帯（ＩＦ帯）に周波数変換される。ＩＦ帯に周波数変換された受信信号は、ＢＰＦ通過後、自動利得制御回路（ＡＧＣ：ＡｕｔｏｍａｔｉｃＧａｉｎ　Ｃｏｎｔｒｏｌ）により、適正な信号レベルに補正された後、準同期検波されベースバンドに周波数変換される。ベースバンドに周波数変換された受信信号は、低域通過フィルタ（ＬＰＦ）通過後、アナログ－ディジタル変換（Ａ／Ｄ変換）され、デジタル信号となり、出力される。

【００２７】受信無線部１２から出力された受信デジタル信号は逆拡散部１３および１３′において逆拡散され、各基地局ＢＳ１およびＢＳ２において発生された狭帯域の変調信号として出力される。逆拡散部１３および１３′から出力された信号は、それぞれ、復調部１４および１４′において復調される。

【００２８】ついで、ＴＰＣビット抽出部１５において、基地局ＢＳ１およびＢＳ２から送られたＴＰＣビットを各復調信号より抽出する。抽出されたＴＰＣビットは、ＴＰＣビット選択部１６において比較される。ＴＰＣビットが異なった場合には、より小さな、移動局の送信電力を指示するＴＰＣビットが選択され、送信電力制御部１７へ出力される。送信電力制御部１７は、選択されたＴＰＣビットに基づき送信電力を決定し、制御情報を送信無線部２６に出力する。

【００２９】一方、逆拡散部１３および１３′内の希望波受信電力検出部１８および１８′、干渉波受信電力検出部１９および１９′は、基地局ＢＳ１およびＢＳ２からの希望波受信電力、各基地局からの希望波に対する干渉波受信電力を各々検出する。検出された希望波受信電力、干渉波受信電力に基づいて、ＳＩＲ算出部２０および２０′は、基地局ＢＳ１からの信号の受信ＳＩＲ、基地局ＢＳ２からの信号の受信ＳＩＲを求める。ＳＩＲ選択部２１は、基地局ＢＳ１からの信号の受信ＳＩＲと、基地局ＢＳ２からの信号の受信ＳＩＲとを比較し、受信ＳＩＲの値の大きい方を受信ＳＩＲとして選択する。選択された受信ＳＩＲの値は、送信電力制御ビット決定部２２において、あらかじめ設定されている目標ＳＩＲと比較される。送信電力制御ビット決定部２２は、受信ＳＩＲが目標ＳＩＲよりも小さい場合には、送信電力の増加を指示する制御ビットを発生し、逆に、受信ＳＩＲが目標ＳＩＲよりも大きい場合には、送信電力の減少を指示する制御ビットを発生し、信号発生部２３に出力する。

【００３０】信号発生部２３は、送信電力制御ビット決定部２２から送られた送信電力制御ビットを含む送信フレームの構成を行い、変調部２４に出力する。送信信号は変調部２４で変調され、ついで拡散部２５で拡散された後、送信無線部２６に出力される。送信無線部２６いおいて、ＩＦ、ＲＦ帯に周波数変換された送信信号は、送信電力制御部１６から出力された制御情報に基づいた送信電力で送信される。

【００３１】

【発明の効果】以上詳細に説明したように、本発明によれば、ソフトハンドオーバ中に送信電力制御を行う場合、ソフトハンドオーバ先の基地局およびソフトハンドオーバ元の基地局からのＴＰＣビットが異なった場合に、移動局は、より小さな送信電力を指示するＴＰＣビットの指示に従い、自局の送信電力を決定するとともに、ソフトハンドオーバ先の基地局およびソフトハンドオーバ元の基地局から送られてきた信号の移動局受信ＳＩＲのうち、大きい方のＳＩＲ値に基づいて、基地局用ＴＰＣビットを決定することにより、クローズドループによる送信電力の制御を行うので、高精度の送信電力制御が可能である。その結果、送信電力の低減を図ると共に、加入者容量の増加を図ることができる。

【図面の簡単な説明】

【図１】ＳＨＯを行う場合の一般的モデル図である。

【図２】従来の送信電力制御方式の説明図である。

【図３】本発明による第１の送信電力制御方法の説明図である。

【図４】本発明による第２の送信電力制御方法の説明図である。

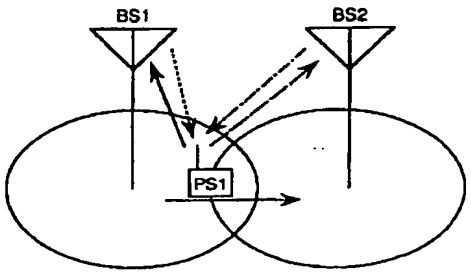
【図５】本発明による第３の送信電力制御方法の説明図である。

【図６】本発明による第３の送信電力制御方法を適用した移動局装置の一実施例を示すブロック図である。

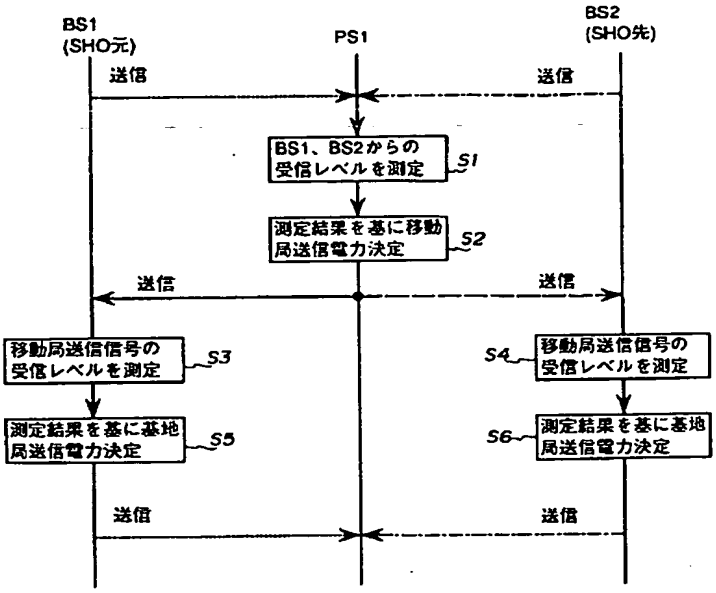
【符号の説明】

ＰＳ１　移動局
ＢＳ１　ＳＨＯ元の基地局
ＢＳ２　ＳＨＯ先の基地局
１０　アンテナ
１１　送受分離部
１２　受信無線部
１３，１３′　逆拡散部
１４，１４′　復調部
１５　ＴＰＣビット抽出部
１６　ＴＰＣビット選択部
１７　送信電力制御部
１８，１８′　希望波受信電力検出部
１９，１９′　干渉波受信電力検出部
２０，２０′　ＳＩＲ算出部
２１　ＳＩＲ選択部
２２　ＴＰＣビット決定部
２３　信号発生部
２４　変調部
２５　拡散部
２６　送信無線部

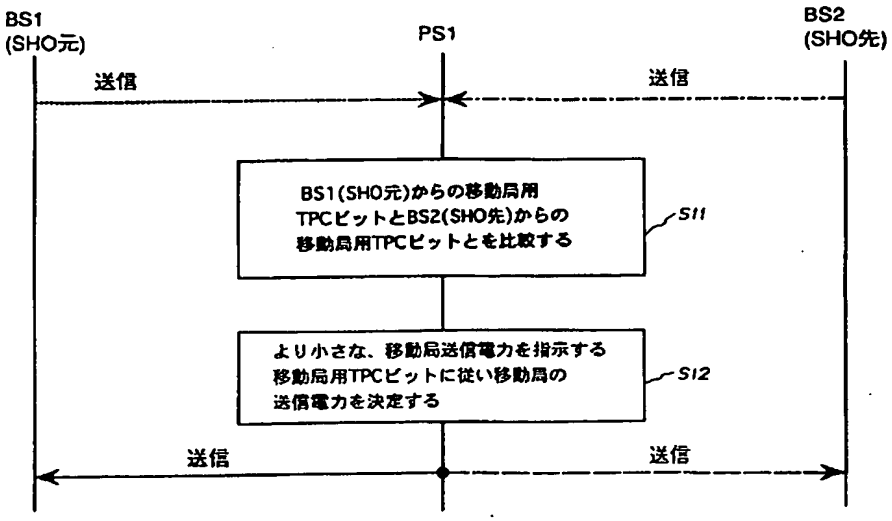
【図１】



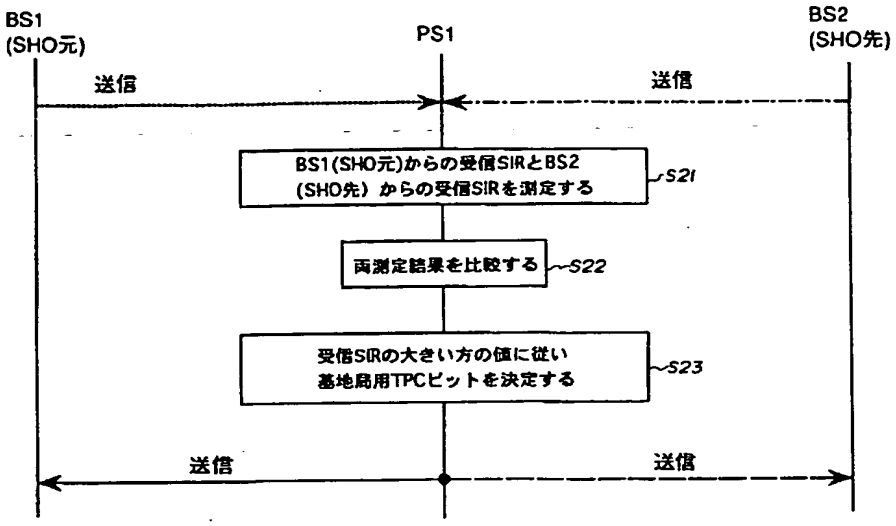
【図２】


BS1
(SHO元)
PS1
BS2
(SHO先)
送信
送信
BS1、BS2からの
受信レベルを測定
S1
測定結果を基に移動
局送信電力決定
S2
送信
送信
移動局送信信号の
受信レベルを測定
S3
S4
移動局送信信号の
受信レベルを測定
測定結果を基に基地
局送信電力決定
S5
S6
測定結果を基に基地
局送信電力決定
送信
送信

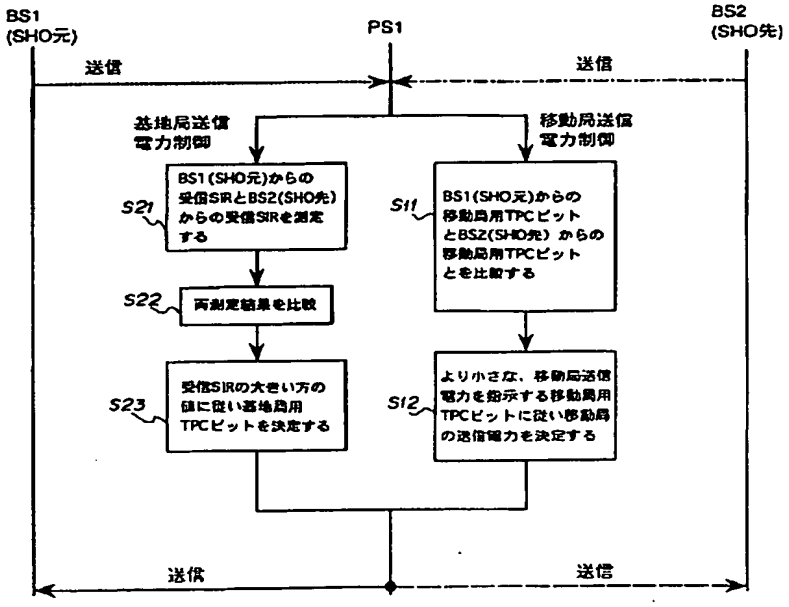
【図３】


BS1
(SHO元)
PS1
BS2
(SHO先)
送信
送信
BS1(SHO元)からの移動局用
TPCビットとBS2(SHO先)からの
移動局用TPCビットとを比較する
S11
より小さな、移動局送信電力を指示する
移動局用TPCビットに従い移動局の
送信電力を決定する
S12
送信
送信

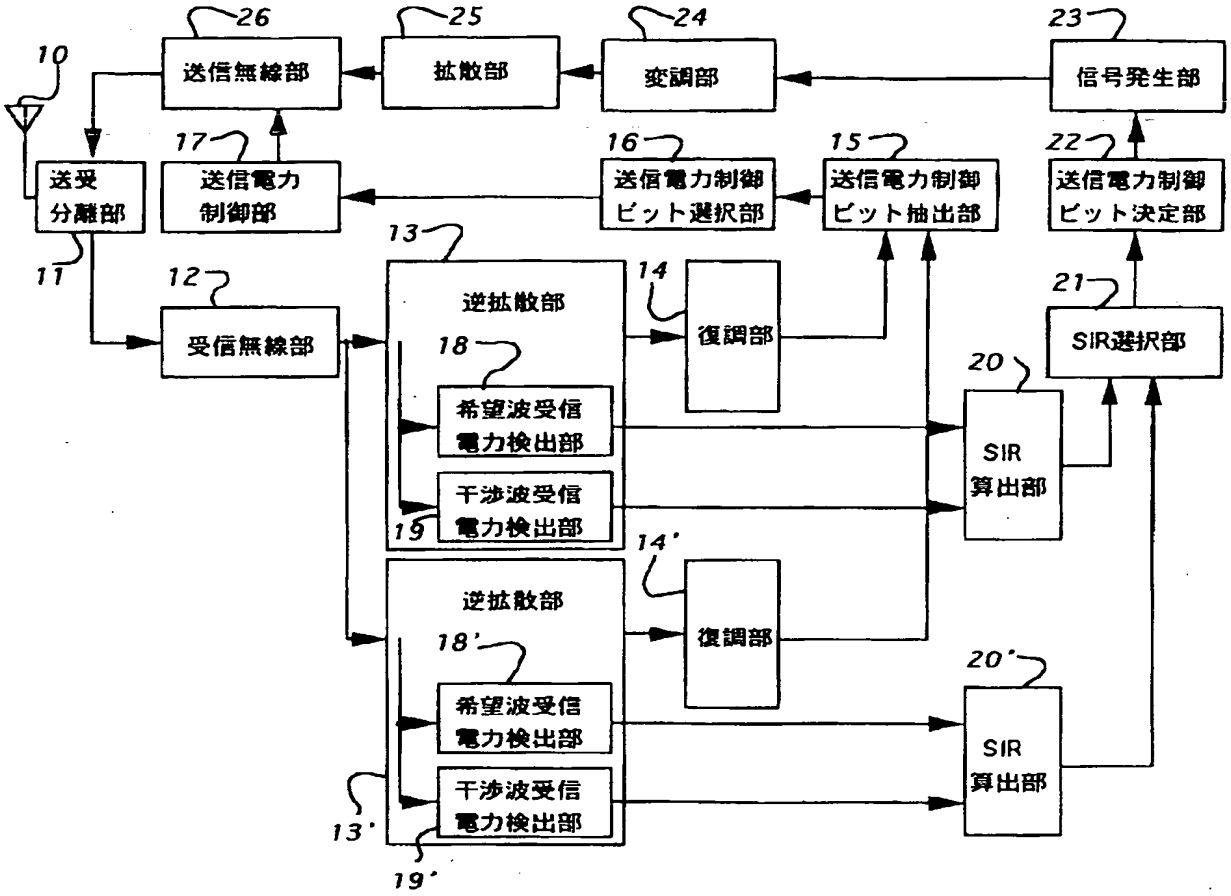
【図４】


BS1
(SHO元)
PS1
BS2
(SHO先)
送信
送信
BS1(SHO元)からの受信SIRとBS2
(SHO先) からの受信SIRを測定する
S21
両測定結果を比較する
S22
受信SIRの大きい方の値に従い
基地局用TPCビットを決定する
S23
送信
送信

【図５】


BS1
(SHO元)
PS1
BS2
(SHO先)
送信
送信
基地局送信
電力制御
移動局送信
電力制御
S21
BS1(SHO元)からの
受信SIRとBS2(SHO先)
からの受信SIRを測定
する
S22
両測定結果を比較
S23
受信SIRの大きい方の
値に従い基地局用
TPCビットを決定する
S11
BS1(SHO元)からの
移動局用TPCビット
とBS2(SHO先) からの
移動局用TPCビット
とを比較する
S12
より小さな、移動局送信
電力を指示する移動局用
TPCビットに従い移動局
の送信電力を決定する
送信
送信

【図６】



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